DOCUMENT RESUME

ED 465 640 SE 066 363

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TITLE	Interacting with Elementary Interns about Their Perceptions of Science Teaching.
PUB DATE	2002-01-00
NOTE	13p.; In: Proceedings of the Annual International Conference of the Association for the Education of Teachers in Science (Charlotte, NC, January 10-13, 2002); see SE 066 324.
AVAILABLE FROM	For full text: http://aets.chem.pitt.edu.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Elementary Education; Elementary School Teachers; *Freehand Drawing; Higher Education; *Preservice Teacher Education; *Science Instruction; *Visual Perception

ABSTRACT

This research investigated three elementary preservice teachers' perceptions of elementary science teachers. Three questions guided this investigation. What images did elementary Masters of Arts in Teaching (M.A.T.) interns have of science teaching at the beginning and end of science methods courses? What changes, if any, did they make in their perceptions? To what sources did they attribute their images of science teaching? Even though the number of research participants is decidedly limited, their responses shed more insight on the investment that science educators should make to influence preservice teachers' perceptions. In doing so, this study provides an interpretative approach that Anderson and Mitchener (1994) say is needed to improve science education. The three students were asked to draw a picture of a science teacher at work several times over the course of the study. The findings included that the three interns had images of science teachers that were consistent with the vision of the National Science Education Standards. Specifically, the teachers in the drawings were standing beside the students (with one exception) offering guidance. The students in the pictures were actively engaged in the activities, conducting investigations, and collecting data. The female interns drew female teachers while the male drew male teachers. No one drew a teacher who was an underrepresented minority. (Contains 21 references.) (MVL)

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INTERACTING WITH ELEMENTARY INTERNS ABOUT THEIR PERCEPTIONS OF SCIENCE TEACHING

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Background

The theme for the 2002 Association for the Education of Teachers in Science conference suggested that there were costs associated with improving scientific literacy for global success. In our capitalistic society, the idea that "there's no free lunch" prevails. There is a price tag associated with each service and product that we receive, whether the expense is tangible or intangible. In terms of teacher preparation, Anderson and Mitchener (1994) summarized an argument that Dewey (1904) presented against teacher education in which a preservice teacher may become competent in an "immediate skill" at the cost of power to grow continually. Whatever the expense, teacher preparation programs should prepare prospective teachers to become lifelong learners and critical thinkers, a stance adopted by the Interstate New Teacher in Assessment and Support Consortium ([INTASC], 1996) and the National Science Education Standards (National Research Council [NRC], 1996). To assist elementary preservice teachers in their preparations, Bentley, Ebert, and Ebert (2000), Carin (1997), Howe and Jones (1998) and many other scholars recommend that science educators provide opportunities for reflection that lead to developing competence.

The National Science Education Standards (NRC, 1996) advocates teacher preparation that includes a wide range of activities, including those that engage preservice teachers as active learners. The instructor of the methods course met this goal by providing various perspectives on teaching science. For example, he focused on questioning skills that Carin (1997) emphasized,

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conceptual learning that Bentley, Ebert, and Ebert (2000) synthesized, several content standards that the *South Carolina Science Curriculum Standards* (South Carolina Science Curriculum Standards Revision Team, 1996) contained, and various teaching strategies that Howe and Jones (1998) described. In doing so, the interns had opportunity to share relevant experiences from their school sites, discuss the assigned readings for which they developed questions, and participate in elementary science activities that preceded additional discussions.

Research Questions

We collaborated to investigate three elementary preservice teachers' perceptions of elementary science teachers. Three questions guided this investigation. What images did elementary M.A.T. interns have of science teaching at the beginning and end of a science methods course? What, if any, changes did they make in their perceptions? To what sources did they attribute their images of science teaching? Even though the number of research participants is decidedly limited, their responses shed more insight on the investments that science educators should make to influence preservice teachers' perceptions. In doing so, this study provides an interpretative approach that Anderson and Mitchener (1994) say is needed to improve science education.

Data Collection Method

This investigation used constructivism as a referent for understanding elementary preservice teachers' views on teaching science. Despite the several faces of constructivism, there are common characteristics associated with this epistemology. Within the context of science teaching and learning, constructivists state that authentic learning results from the learner's active

participation in the education process, connections made with prior knowledge, and manipulation and interaction with ideas and/or objects to facilitate understanding (Arons, 1989; McDermott, 1991; von Glasersfeld, 1993; Tobin, 1993; Wheatley, 1991). Therefore, knowledge is always contextual and personal (O' Laughlin, 1992; Tobin & Tippins, 1993; von Glasersfeld, 1989; von Glasersfeld, 1993; Wheatley, 1991). Information that is obtained through experiential processes is assimilated within the learner's existing cognitive schema. Inherent in the acquisition of knowledge, the learner develops the ability to interpret and apply knowledge to situations outside the context in which it was initially acquired (McDermott, 1991; Wheatley, 1991).

The research questions within this theoretical framework required in the use of qualitative research methods. The best-known components of qualitative research are participant observations and semi structured interviews (Lincoln & Guba, 1985; Bogden & Bicklin, 1992; Ely, Anzu, Friedman, Garner, & McCormmack Steinmetz, 1991). In his study of how urban middle school science teachers benefited from an intense professional development program, Carnes (1996) found that classroom teachers had difficulty describing images of science teaching within their own classrooms. Our assumption was that preservice teachers were no more articulate than those experienced educators, particularly since their experience base was more limited. Therefore, we used the Draw-A-Science-Teacher-Test-Checklist (DASTT-C) instrument as a framework in helping the research participants share their perceptions.

In the third and most recent version of the DASTT-C instrument, Thomas, Pedersen, and Finson (2001) added an illustration and narrative data component. These developers came to the conclusion that short, personal narratives might provide additional insight on certain components and aspects of illustrations that research participants drew, replacing the oral interviews that would be impractical with large groups of participants. Thomas et al. (2001) asked, "Draw a

picture of yourself as a science teacher at work" (p.310). Also, the developers provided their preservice teachers with #2 pencils or markers. For our purposes, we made a slight modification to the instrument and to its administration. We made the drawing prompt less personal, asking the three participants to draw a picture of a science teacher at work. In our study, the participants used the pencil or pen that they brought to class and had 15 to 20 minutes to complete the test.

Backgrounds of the Preservice Teachers

The interns were three M.A.T. interns who were fifth year interns and had recently completed the science methods course that was described earlier. They successfully earned an undergraduate degree at the university and 18 credit hours in its Education Minor program. Meeting one of the admission requirements, these interns completed a minimum of seven semester hours of science courses offered outside of the College of Education. Each of these interns only had the minimum number of credit hours and had varying background experiences.

Betty was a white female who had negative experiences with science during her elementary and secondary school years even though she performed very well in academic areas and was in the gifted program. In the following quote, she shares her vivid memory of her dislikes for science and the experiences that contributed to them. As a result of her experiences, Betty sought opportunities to avoid taking additional science courses. Although she did fulfill the required number of science courses for the teacher preparation program, she began the science methods course with a high level of anxiety. In the following quote, she detailed her reservations.

> I wish I could stand before you and say that my elementary experiences with science were rich and fulfilling and that I developed a passion for science due to my wonderful experiences; the truth is quite the opposite. My science teachers used direct instruction. The teacher would stand in front of the class and proceed to ask us to open our textbooks to whatever page we were to be on that day and continue to read almost straight from the book. Some days the teacher would use

> an overhead projector, but most days he/she would not. No connections were ever made to my life and there was no correlation to other subject areas like math, art, literature, music, P.E., etc. I never had much experience with hands-on activities. So, you can imagine my anxiety level every year when we were mandated to enter the science fair. I felt ignorant, inferior, defeated, and utterly embarrassed *every year* [her emphasis] at the science fair. I even remember crying and begging my parents not to go to see the displays at the school because I was so ashamed.

On the other hand, Olivia, an African-American female, shared mostly positive experiences in her elementary and secondary education. The following quote serves as a summary of her sentiments.

> I have had the enlightened experience of being educated in both public and private schools in 3 different states along the east coast; Georgia, South Carolina, and Connecticut during my young life. Each experience in my science education was quite different. I had the most memorable experiences in my eight grade Physical Science and ninth grade Biological Science classes. During these two years, we spent significant time on class experiments, uncovering course content, and researching various projects.

Hal was a White male who had very positive experiences since his early childhood days. For example, his father bought him a telescope when he was very young, allowing him to explore the sky and heavenly bodies. As he related in the following quote, his second grade teacher contributed to his growing interest in science.

> My second-grade teacher was a positive influence in science teaching. She allowed me to do demonstrations for the class out of our textbooks that were normally overlooked by other teachers. She was also always willing to allow me to share any science ideas with the class.

Unlike the first two interns, Hal completed a science methods course that was designed for classroom teachers prior to his entry in the M.A.T. program. In addition, he delayed his entry into the degree program for one year, working in an observatory at the university to earn money for his graduate education. In various conversations, he consistently related his enthusiasm about science and science teaching.

In her first drawing, Betty drew a picture of a teacher standing by a desk where two students were working. Based on the remarks in the balloons coming from the students' mouths, the students are interested in what they are doing. In her narrative, Betty stated that the teacher was allowing the students to be engaged in hands-on experiments and discoveries. The second illustration, drawn at the end of the science methods course, was similar to the first one. The teacher is facilitating the students' inquiries. Betty indicated,

> She [the teacher] was encouraging cooperative learning and conversations about science. Instead of teaching by direct instruction, the teacher is allowing her students to make connections and constructions of their own learning. There's no busy work going on in here, only valuable learning experiences that are taking place. The teacher is not telling students exactly what to do, but rather using great questioning skills to help facilitate learning.

Betty showed a few changes in her view of elementary science teaching. She made greater use of professional language in the caption associated with her second illustration. Also, her drawing had more detail. She depicted the teacher asking open-ended questions that probed thought provoking responses. The students are working collaboratively and each group has different engagements. The students are engaged and teaching themselves and their classmates. However, neither of the drawings featured teacher-centered instruction.

At the beginning of the semester, Olivia drew a female teacher who appeared to be posing for the picture, with students in the background. Her intention was to illustrate a teacher observing her students as they demonstrated how to properly measure materials and liquids. All of the students had the equipment and materials needed for this investigation at their tables and were smiling. At the end of the course, Olivia provided a new illustration of a teacher at work that was very similar to her first one, although the students were in the foreground of the

drawing. It was interesting to note that both of the teachers that she drew were White, neither looking like someone who shared her African-American heritage.

In his first drawing, Hal depicted students with their teacher in the schoolyard observing stars, a comet, and the moon. There was a large telescope nearby to aid them with their observations. The students who have "!" over their heads were "inspired" while those having "?" were asking questions. The student who has a light bulb over his head has finally grasped a difficult concept. In his second and final drawing, Hal focused on the personable interactions that an elementary science teacher has with his student. While both his drawings contained an astronomy theme, the group instruction size was noticeably different. In his first illustration at the beginning of the semester, it is difficult to be able to tell whether the teacher is male or female. However, in the second drawing the teacher is decidedly a male.

Sources of Perceptions

In response to the writing prompt given with each test, the interns identified the sources that contributed to their illustrations. Although they had a good rapport with the course instructor and indicated their enjoyment of the course activities on several occasions, there were other factors and experiences that were more influential than what they drew. For example, Betty explained that her eighth and ninth grade science teachers, as well as her observations in the fall internship, helped to change her perceptions of science teachers. In the following elaboration, she shared other enabling factors.

> It is only now, after I have taken my science methods courses and read various professional publications that I have come to believe that *everyone* has a scientific mind and *everyone* can be successful if the right mode of instruction is utilized [her emphases].

As indicated earlier, Olivia had a variety of experiences with science teachers. These experiences contributed to her first illustration. At the end of the semester, she stated that, "These classes, in conjunction with my Science Methods course, helped me develop a deeper understanding and greater appreciation for science and science teachers." The classes that she identified specifically included her eight and ninth grade experiences.

Interestingly, Hal's learning experiences with his high school algebra teacher who related real world science and math applications contributed to his first illustration. It was evident that his interest in astronomy also influenced what he drew. For his second illustration, Hal acknowledged multiple experiences that framed his concept of an elementary science teacher. For example, his work with fifth graders during his fall internship and experiences with the text that Bentley et al. (2000) contributed to the following sentiment:

> I found myself desiring to show students the "why" of a concept, and found myself caring for them and their science learning. It was no longer about merely inspiring them, but wanting to know how they've changed their perceptions about a scientific concept.

Final Remarks

In summary, these three fifth-year interns had images of science teachers that were consistent with the vision of the National Science Education Standards (NRC, 1996). Specifically, the teachers in the drawings were standing beside the students (with one exception), offering guidance. The students were actively engaged in the activities, conducting investigations and collecting data. The female interns drew female teachers while the male drew male teachers. No one drew a teacher who was an underrepresented minority.

In all three cases, there were no changes in philosophical views. Each of the illustrations contained elements of constructivism that was noted earlier in this paper. There are at least two

reasons for why the interns' perspectives were unchanged. As evident in *A Private Universe*, learners not only construct their own meanings, they are reluctant to release those constructions. Furthermore, the content and emphases of the science methods course reinforced the interns' views on the appropriateness of active learning and inquiry teaching.

As noted earlier, the interns enjoyed the science methods course and found the activities to be meaningful. However, their personal theories and experiences were most influential in their perception of elementary teaching. Their images of science teaching are what they think science teaching should be, regardless of their experiences. For example, Betty had negative science learning experiences. Yet, her first illustration was very different that what she experienced in elementary school. Interactions with these interns suggest that a science methods course in which students read and discuss science education issues and participate in inquiry learning activities is not enough to change perceptions, by itself. As the NRC (1996) suggested, an elementary science methods course needs to include personal vignettes, teaching episodes at a practicum site, and other activities that allow interns to be active learners. In fact, methods instructors need to use school-based experiences as the basis for preparing teacher interns and use sound scholarly material to supplement and make meaning of those experiences.

More studies are needed to identify at what costs an instructor can modify preservice teachers' perceptions of elementary science teaching through these engagements. For example, what is a desirable balance between school-based experiences and methods course activities? How likely is it that interns will modify their perceptions within a semester? For now, it seems apparent that preservice teachers enroll in science methods courses with science learning experiences and/or perceptions that are already aligned with best practice science teaching. Methods instructors must seize the opportunities to invest in these preconceptions.

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